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Komatsu et al.

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(54) **DEVELOPING DEVICE, PROCESS CARTRIDGE AND IMAGE FORMING APPARATUS**

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(51) **Int. Cl.**[7] **G03G 15/08**; G03G 21/18
(52) **U.S. Cl.** **399/113**; 399/119
(58) **Field of Search** 399/119, 222, 399/228, 234, 252, 265, 279, 111, 113

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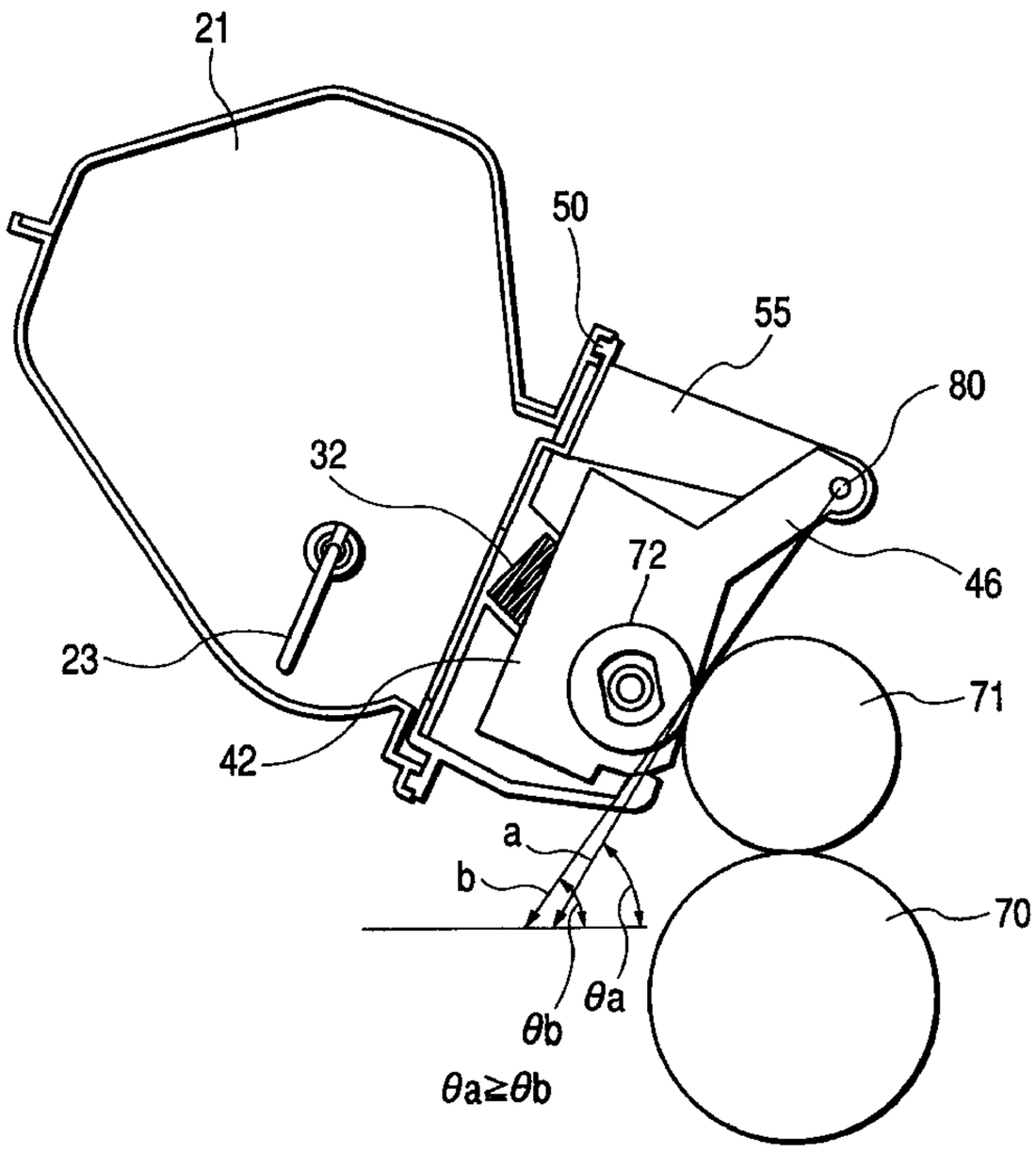
(57) **ABSTRACT**

A developing device has a developing roller for developing an electrostatic latent image formed on an image bearing member, a developer containing portion for containing therein a developer to be supplied to the developing roller, a first frame for supporting the developing roller, a second frame for movably supporting the first frame, and supporting the developer containing portion, and an urging member for urging the developing roller toward the image bearing member.

20 Claims, 12 Drawing Sheets



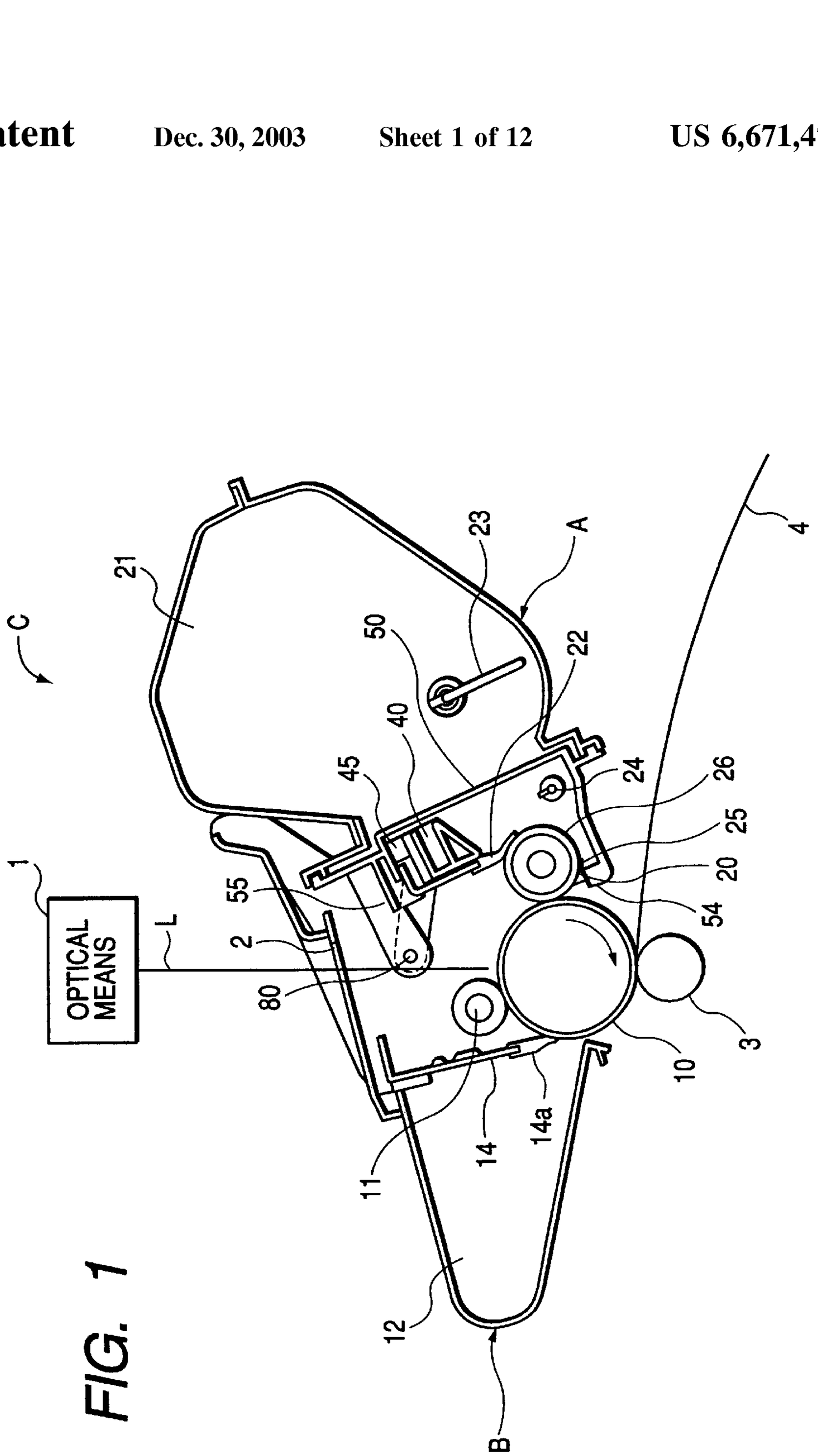

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FIG. 1

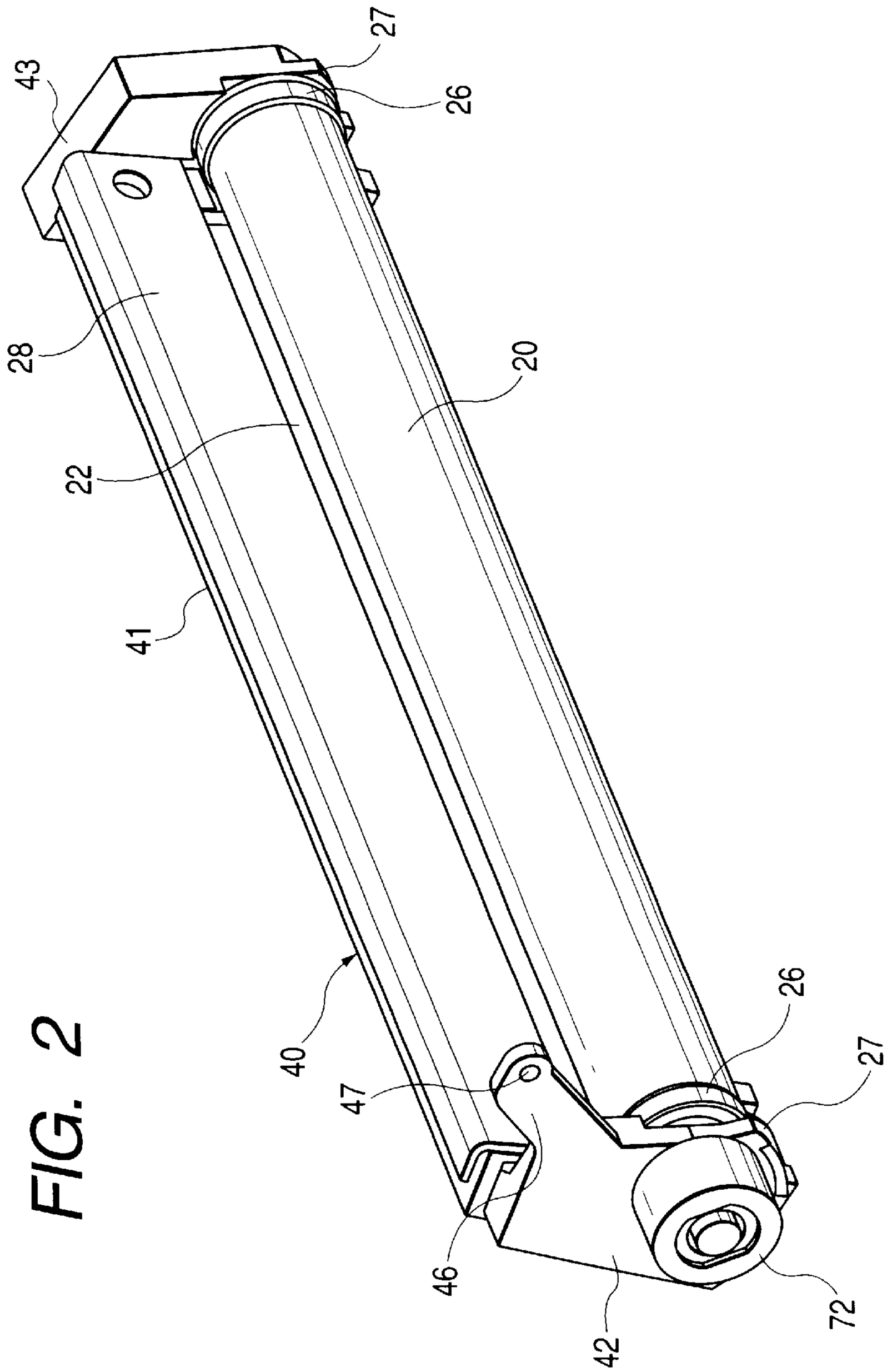


FIG. 2

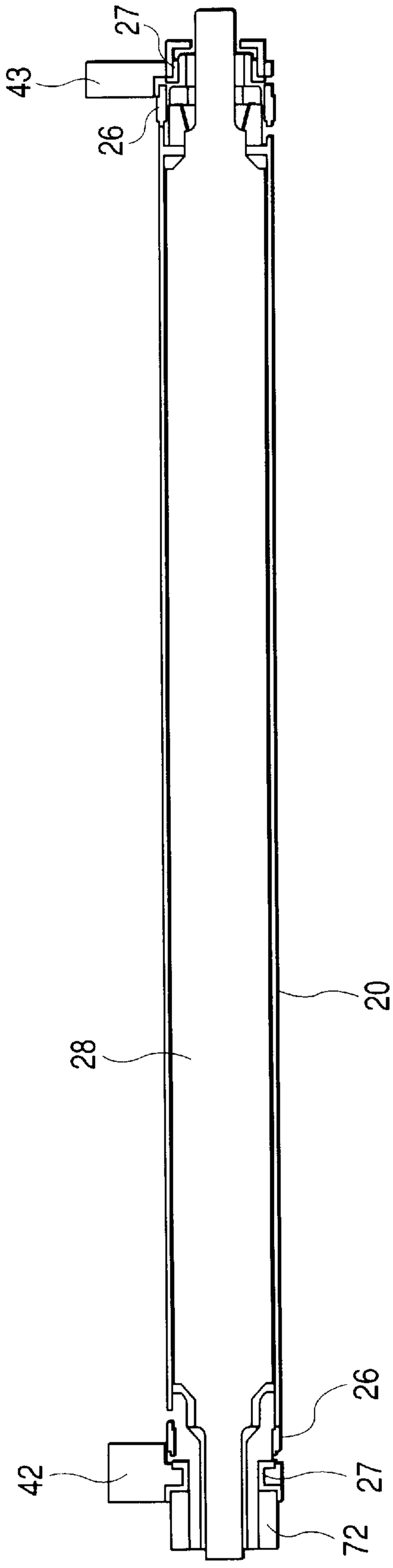


FIG. 3

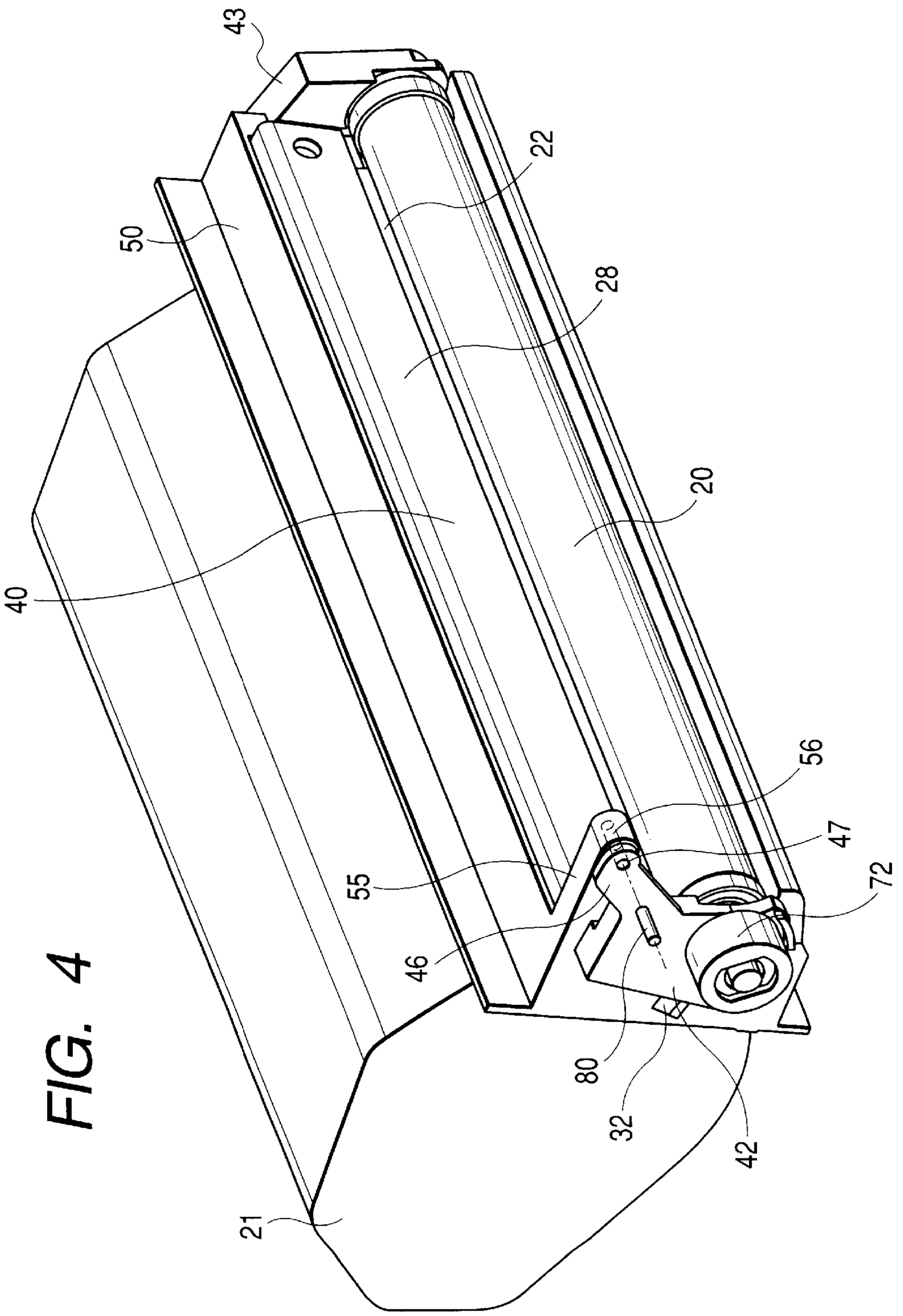
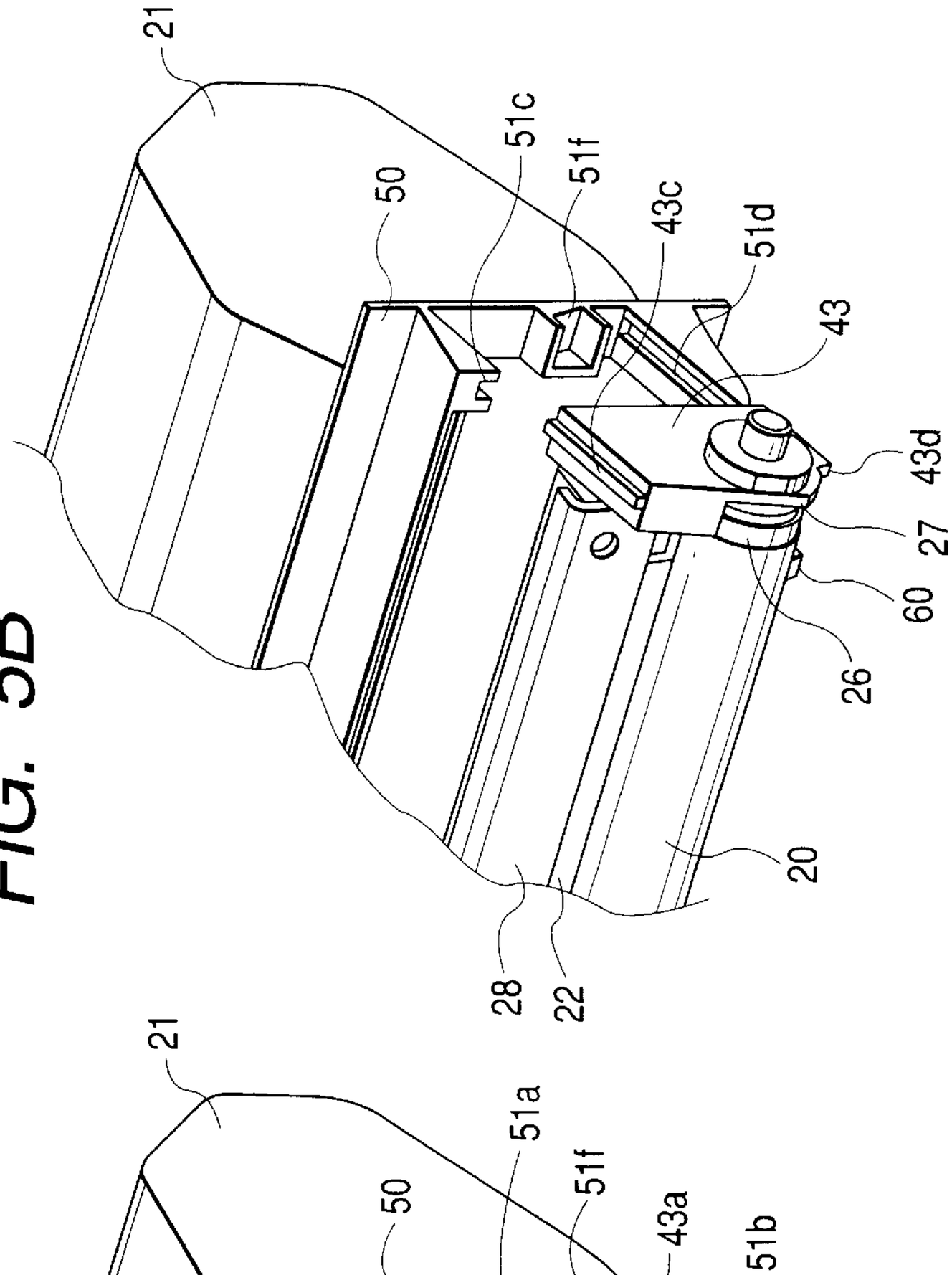


FIG. 4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51d
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51f
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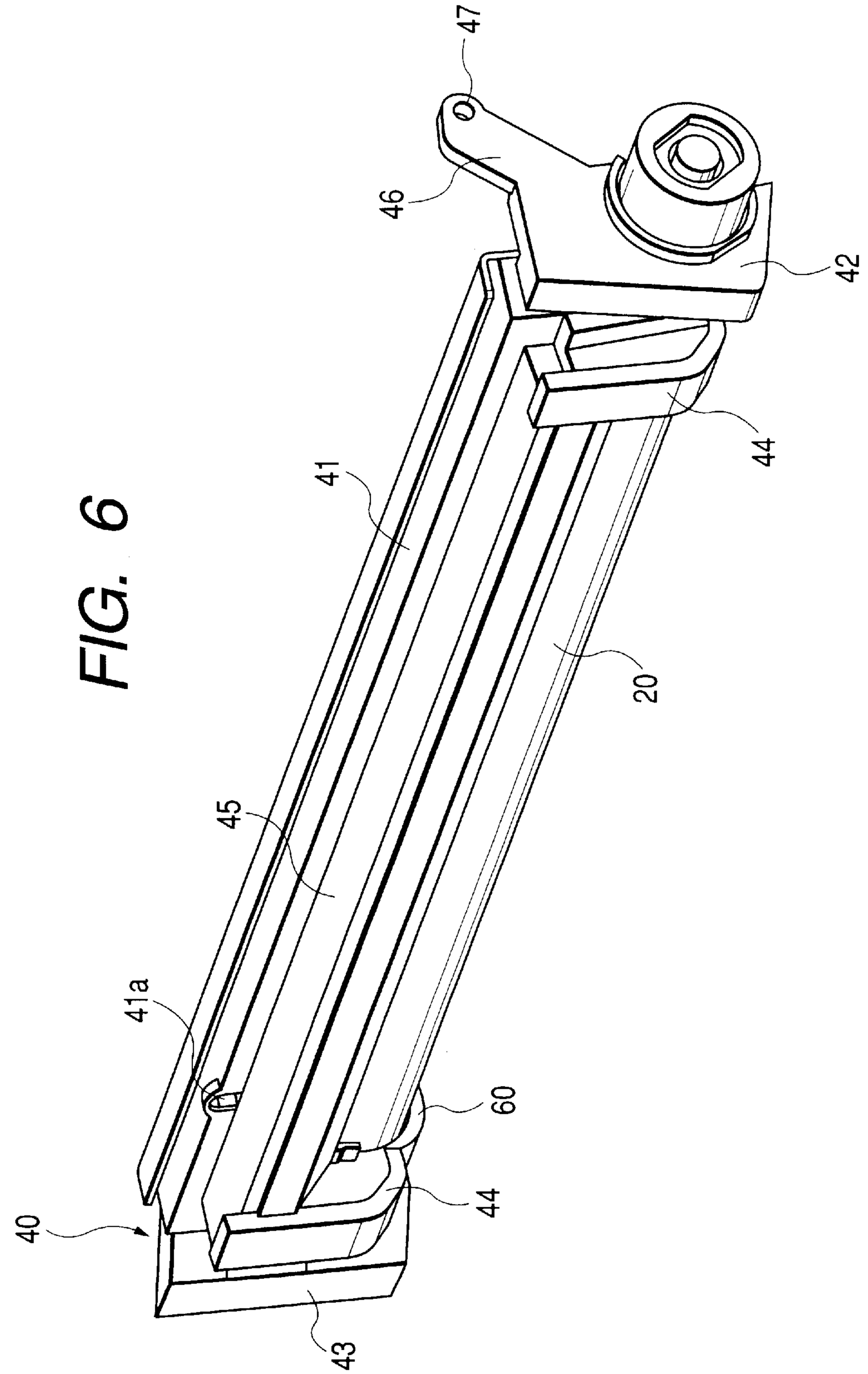
28
22

FIG. 5B

FIG. 5A

FIG. 6



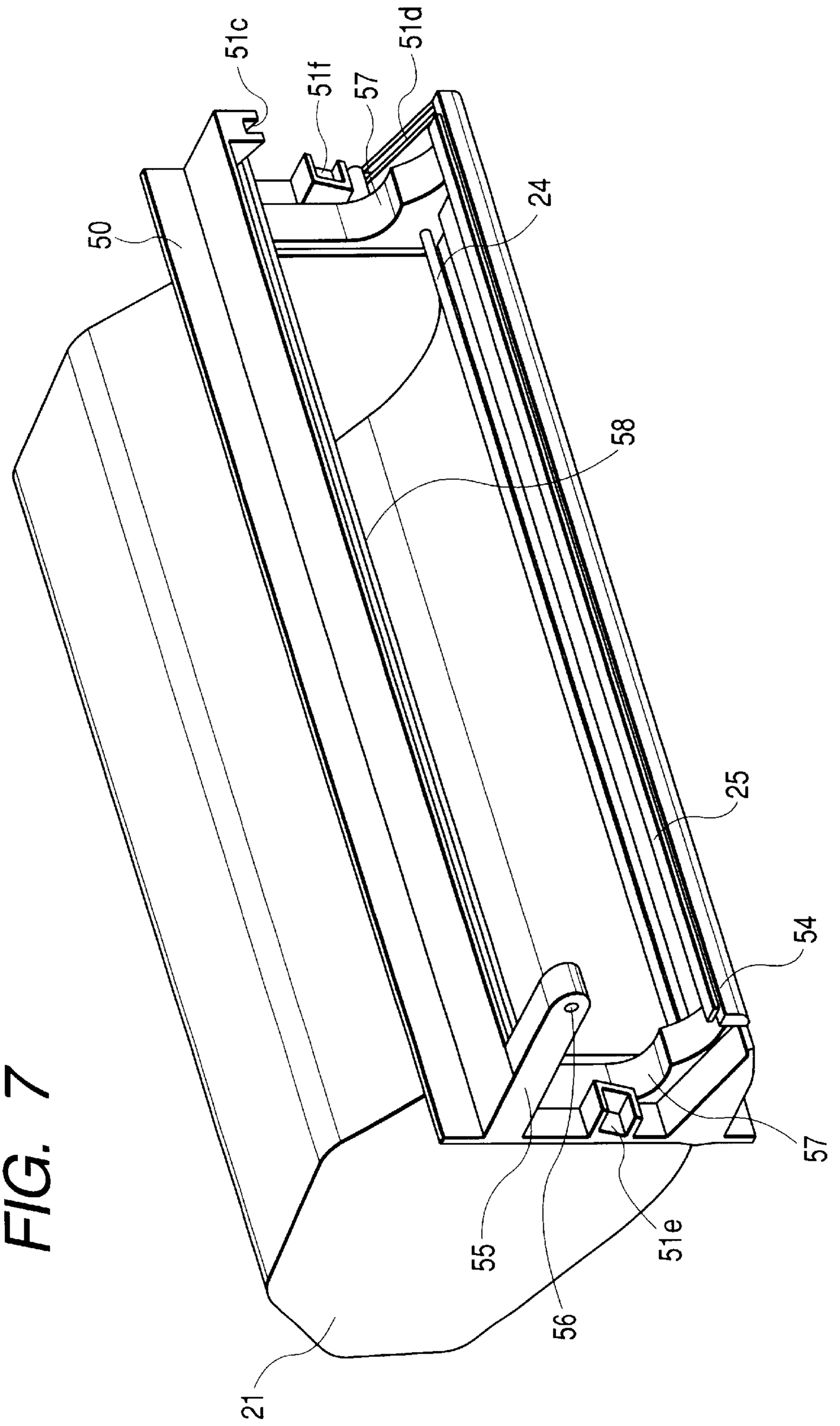


FIG. 7

FIG. 8

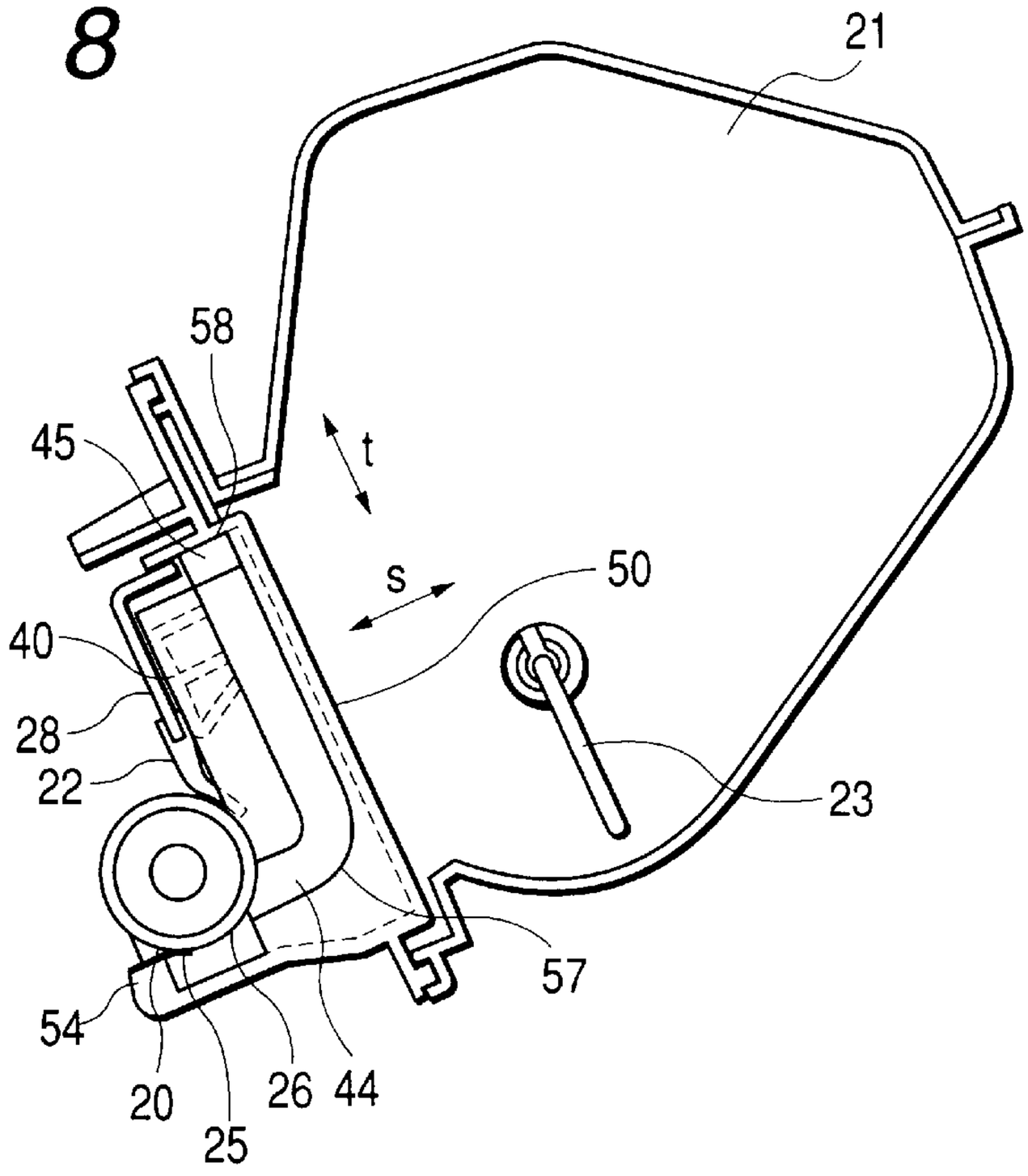


FIG. 9

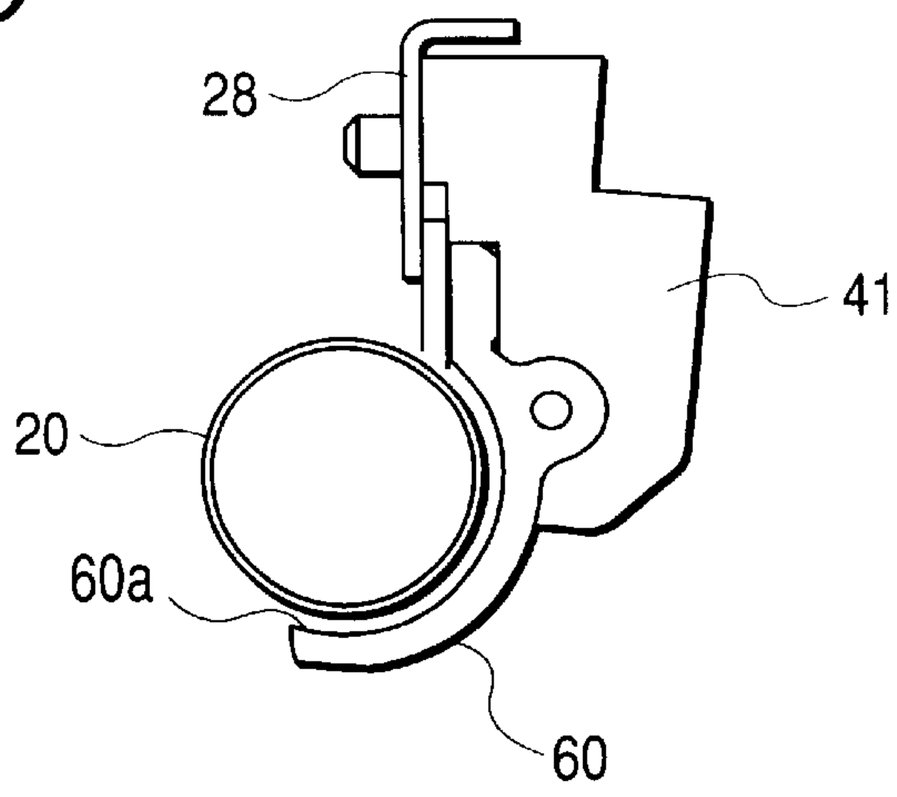


FIG. 10

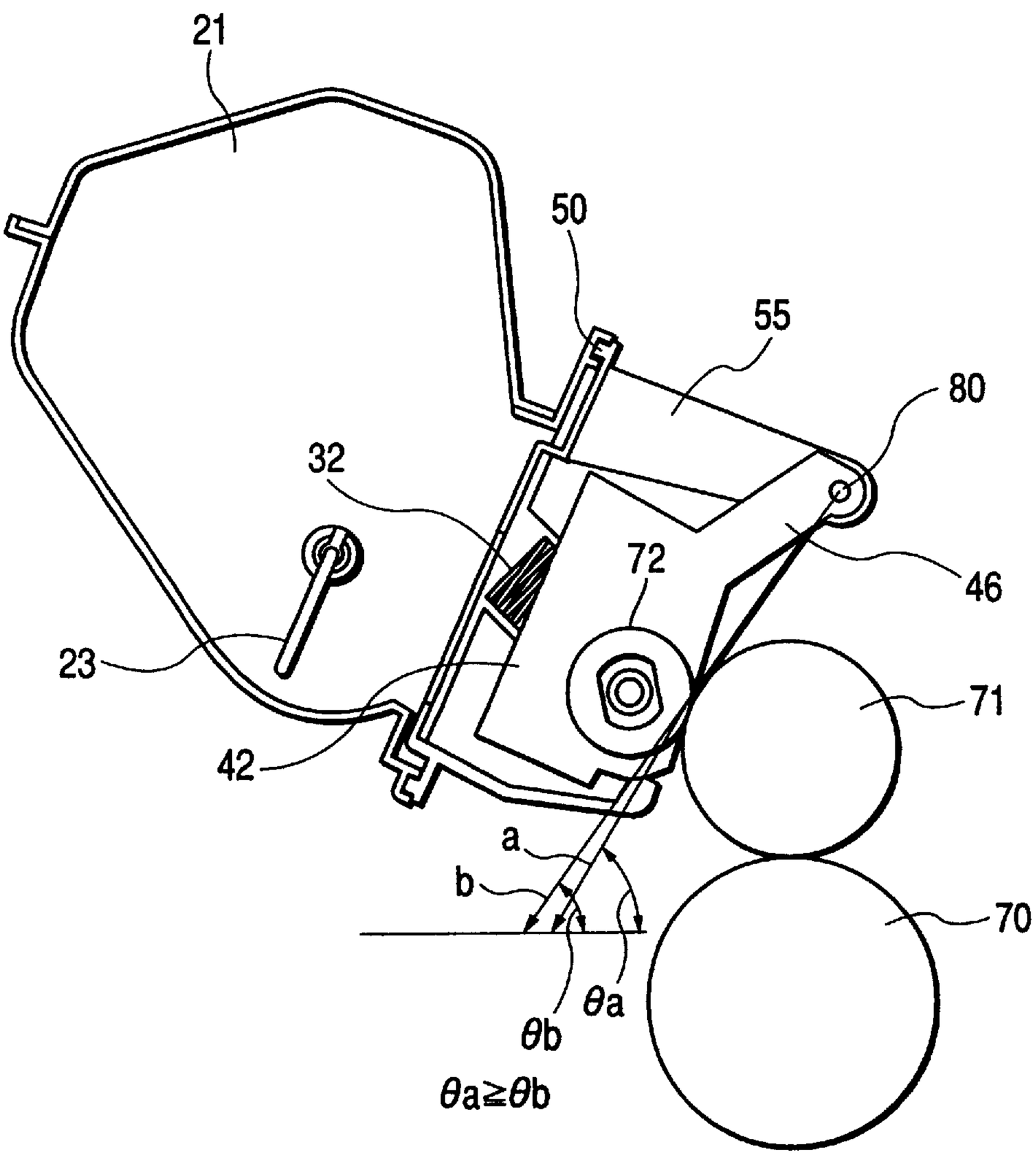


FIG. 11

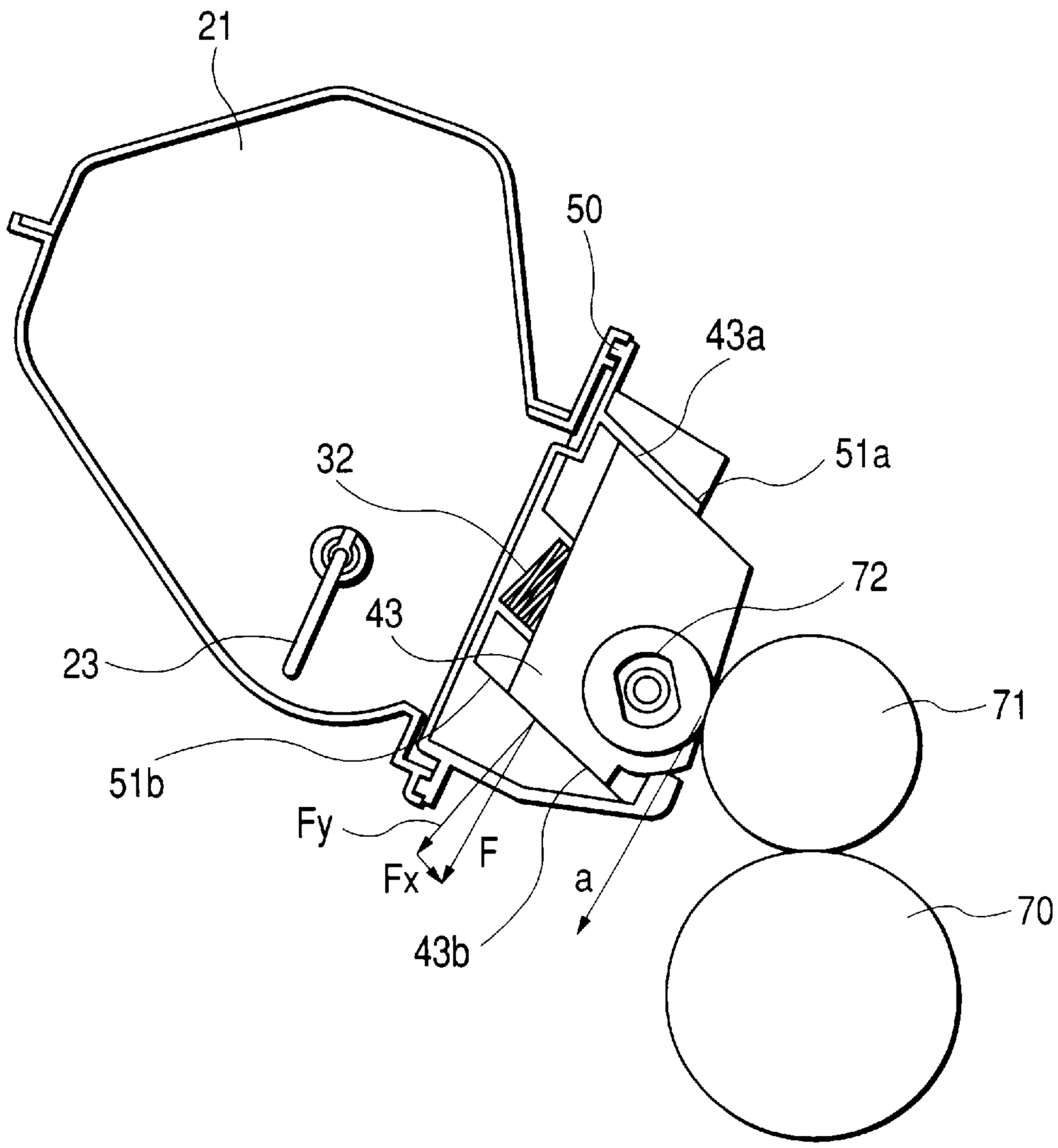


FIG. 12

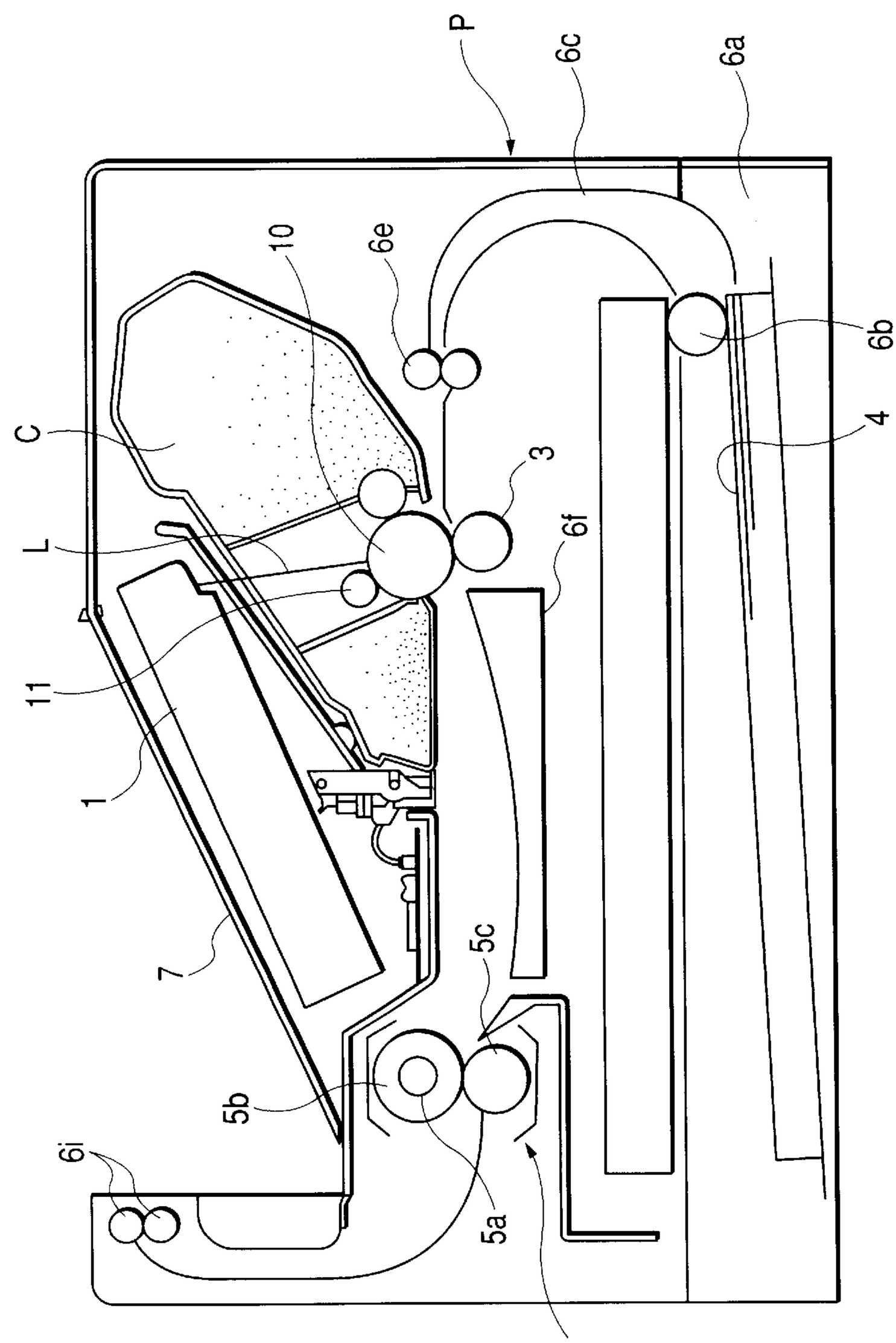
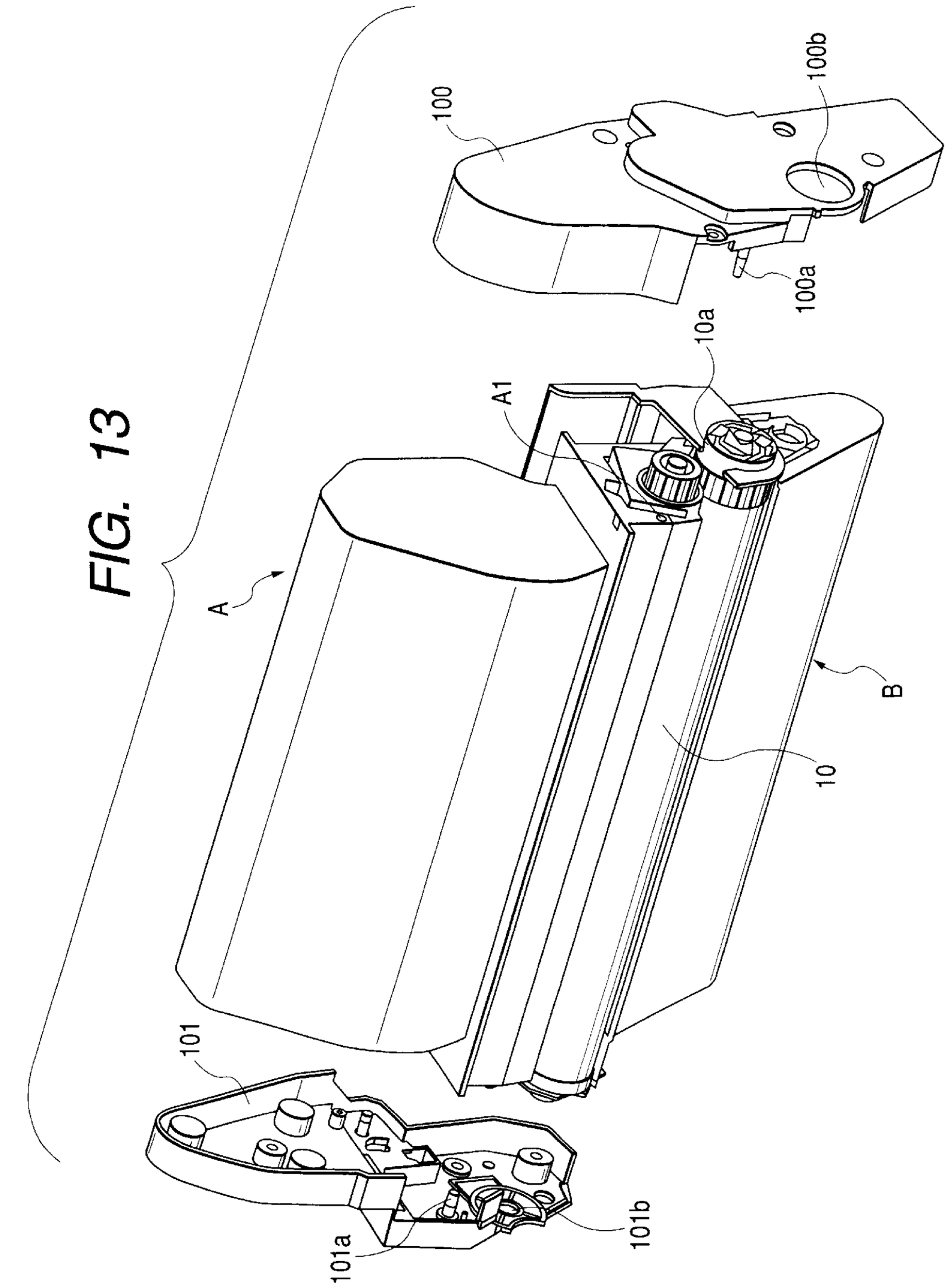


FIG. 13



DEVELOPING DEVICE, PROCESS CARTRIDGE AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a developing device for use in an image forming apparatus of the electrophotographic type, a process cartridge having the same, and an image forming apparatus having the process cartridge.

2. Description of Related Art

The construction of a process cartridge using a developing device according to the conventional art will be described below. In a photosensitive member unit of the process cartridge, there are disposed a photosensitive drum which is an image bearing member on which an electrostatic latent image is formed, charging means for uniformly charging the surface of a photoconductive layer of the photosensitive drum, and cleaning means for scraping off any residual toner not transferred to a recording medium but adhering to the photosensitive drum, and storing the scraped-off toner in a waste toner container.

Also, in a developing unit, there are disposed a toner container containing a toner therein, a developing roller for supplying the toner to the electrostatic latent image formed on the photosensitive drum and forming a visible image, a developing blade for giving triboelectrification charges to the toner and forming a toner layer on the surface of the developing roller, and a jet preventing sheet for preventing the leakage of the toner in the radial direction of the developing roller. The developing unit and the photosensitive member unit are rotatably connected together by an engagement pin. The engagement pin is provided at a location at which the developing roller supported by the developing unit and the photosensitive member supported by the photosensitive drum unit are movable. A biasing spring is provided between the developing unit and the photosensitive member unit so as to urge the developing roller toward the photosensitive drum.

In the above-described developing unit according to the conventional art, however, the developing unit and the photosensitive member unit are rotatably connected and therefore, the weight of the toner in the toner container is added to the pressure force urging the developing roller toward the photosensitive drum. Consequently, the pressure force pressing the developing roller toward the photosensitive drum fluctuates due to the consumption of the toner during image formation. The driving torque of the developing unit also fluctuates with the fluctuation of the pressure force.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a developing device in which the pressure force of a developing roller toward an image bearing member can be stabilized, a process cartridge having the developing device, and an image forming apparatus having the process cartridge.

It is another object of the present invention to provide a developing device in which the pressure force of a developing roller toward an image bearing member can be stabilized independently of the amount of developer in a developer containing portion, a process cartridge having the developing device, and an image forming apparatus having the process cartridge.

It is another object of the present invention to provide a developing device in which the pressure force of a developing roller toward an image bearing member can be stabilized and at the same time, an improvement in the assembling property has been realized, a process cartridge having the developing device, and an image forming apparatus having the process cartridge.

It is another object of the present invention to provide a developing device having:

a developing roller for developing an electrostatic latent image formed on an image bearing drum;

a developer containing portion for containing therein a developer to be supplied to the developing roller;

a first frame for supporting the developing roller;

a second frame for movably supporting the first frame, and supporting the developer containing portion; and

an urging member for urging the developing roller toward the image bearing drum,

a process cartridge having the developing device, and an image forming apparatus having the process cartridge.

These and other objects, features and advantages of the present invention will become more apparent upon consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view illustrating a process cartridge.

FIG. **2** is a perspective view illustrating a first frame.

FIG. **3** is a cross-sectional view illustrating the first frame.

FIG. **4** is a perspective view illustrating the process cartridge.

FIG. **5**A is an enlarged view of essential portions illustrating a slide frame.

FIG. **5**B is an enlarged view of essential portions illustrating a slide frame.

FIG. **6** is a view of the first frame illustrating a toner seal construction.

FIG. **7** is a view of a second frame illustrating the toner seal construction.

FIG. **8** is a cross-sectional view illustrating the direction of compression of the toner seal.

FIG. **9** illustrates the construction of the toner seals on the opposite end portions of a developing roller.

FIG. **10** is a schematic view of a driving system for the developing roller.

FIG. **11** shows the construction in which the developing roller is driven on the slide frame side.

FIG. **12** shows the general construction of an image forming apparatus according to the present embodiment.

FIG. **13** is a perspective view illustrating the construction of a process cartridge.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of an image forming apparatus according to the present invention will hereinafter be described with reference to the accompanying drawings. FIG. **12** shows the general construction of the image forming apparatus according to the present embodiment.

General Construction of the Image Forming Apparatus

The general construction of the image forming apparatus will first be described with reference to FIG. **12**. A laser

beam printer P forms an image on a recording medium **4** (such as recording paper, an OHP sheet or cloth) by an electrophotographic image forming process.

The surface of a photosensitive drum **10** which is a drum-shaped electrophotographic photosensitive member as an image bearing member is uniformly charged by charging means **11**. A laser beam L containing image information is applied from optical means **1** to the photosensitive drum **10** to thereby form an electrostatic latent image conforming to the image information on the photosensitive drum **10**. The thus formed electrostatic latent image on the photosensitive drum **10** is developed by developing means which will be described later to thereby form a toner image.

On the other hand, in synchronism with the formation of the toner image, the recording medium **4** set on a feed cassette **6***a* is conveyed and surface-reversed (turned-over) by a pickup roller **6***b*, a conveying guide **6***c* and a pair of registration rollers **6***e*. The recording medium **4** then passes through a nip portion formed by the photosensitive drum **10** and a transferring roller **3** to which a constant voltage is applied. At this time, the toner image developed on the photosensitive drum **10** is transferred to the recording medium **4**. The recording medium **4** which has been subjected to the transfer of the toner image is conveyed to fixing means **5** by a conveying guide **6***f*. The fixing means **5** has a driving roller **5***c* and a fixing roller **5***b* having a heater **5***a* therein, and applies heat and pressure to the recording medium **4** as the recording medium **4** passes through the nip portion of the fixing means S, thereby fixing the transferred toner image. Thereafter, the recording medium **4** is conveyed by a pair of delivery rollers **6***i* and is delivered to a delivery tray **7**.

Process Cartridge

A process cartridge C will now be described. The process cartridge C is detachably and mountably supported by a supporting means (not shown) of the image forming apparatus as shown in FIG. **12**. As shown in FIG. **1**, in a photosensitive member unit B of the process cartridge C, there are disposed the photosensitive drum **10** for forming an electrostatic latent image thereon, the charging means **11** for uniformly charging the surface of a photoconductive layer of the photosensitive drum **10**, and cleaning means **14** for scraping off from the surface of the photosensitive drum **10** any residual toner not transferred to the recording medium **4** but adhering on the photosensitive drum **10**, and storing the scraped-off toner in a waste toner container **12**.

Also, in a developing unit A, there are disposed a toner container **21** containing toner therein, a developing roller **20** for supplying the toner to the electrostatic latent image formed on the photosensitive drum **10** to thereby form a visible image, and a developing blade **22** for giving triboelectrification charges to the toner to thereby form a toner layer on the surface of the developing roller **20**. Also, in lower openings between the developing roller **20** and a first frame **40** and between the developing roller **20** and a second frame **50**, there are provided jet preventing seals **25** for sealing the lower openings, and these seals **25** have the function of preventing the leakage of the toner in the radial direction of the developing roller **20**.

The developing unit A and the photosensitive member unit B, as shown in FIG. **13**, have their lengthwisely opposite sides integrally connected together and fixed by a side cover **100** and a side cover **101**. Thus, they constitute the process cartridge C. The side cover **100** is provided with a pin **100***a* for positioning with respect to the developing unit A, and an aperture **100***b* for positioning with respect to the photosensitive member unit B, and the pin **100***a* and the aperture **100***b* are fitted to a positioning hole Al formed in the developing unit A and a photosensitive drum bearing **10***a* of the photosensitive member unit B, respectively. Thereby, the relative position of the developing unit A and the photosensitive member unit B is determined. Likewise, the side cover **101** is provided with a pin **101***a* for positioning with respect to the developing unit A, and an aperture **101***b* for positioning with respect to the photosensitive member unit B. The pin **101***a* and the aperture **101***b* are fitted to a positioning hole (not shown) formed in the developing unit A and the photosensitive drum bearing (not shown) of the photosensitive member unit B, whereby the two units are positioned and connected together.

In FIG. **1**, the photosensitive drum **10** is rotated clockwise. The charging means **11** has a constant voltage applied thereto, and the charging means **11** and the photosensitive drum **10** contact each other and the surface of the photoconductive layer of the photosensitive drum **10** is uniformly charged. Then, the laser beam L conforming to the image information from the optical means **1** is applied to the photosensitive drum **10** through an exposure opening portion **2** to thereby form an electrostatic latent image on the photosensitive drum **10**. Thereafter, a toner image is formed on the photosensitive drum **10** by the developing means.

The developing means feeds the toner in the toner container **21** to the developing roller **20** by the rotation of a toner feeding member **23**. The developing roller **20** having a stationary magnet therein is rotated and also, a toner layer, having had triboelectrification charges given thereto by the developing blade **22**, is formed on the surface of the developing roller **20**. The developing roller **20** is urged against the photosensitive drum **10** by a biasing spring **32** (see FIGS. **4** and **10**) while keeping a constant clearance through spacer runners **26**. The toner layer formed on the surface of the developing roller **20** is supplied to the developing area of the photosensitive drum **10**. The toner is shifted to the photosensitive drum **10** in accordance with the electrostatic latent image thereon to thereby form a toner image. The developing blade **22** regulates the amount of toner on the peripheral surface of the developing roller **20** and gives triboelectrification charges. Also, in the vicinity of the developing roller **20**, there is rotatably attached a toner agitating member **24** for circulating the toner in a developing chamber.

A voltage opposite in polarity to the toner image is applied to the transferring roller **3** provided in the main body of the image forming apparatus to thereby transfer the toner image formed on the photosensitive drum **10** to the recording medium **4**. Thereafter, any residual toner on the photosensitive drum **10** is removed by the cleaning means **14**. The cleaning means **14** scrapes off the toner residual on the photosensitive drum **10** by an elastic cleaning blade **14**a provided in contact with the photosensitive drum **10** and collects the scraped-off toner into the waste toner container **12**.

As shown in FIG. **1**, the developing unit A is comprised of the first frame **40** and the second frame **50**. As shown in FIGS. **2** and **3**, the first frame **40** is comprised of a movably supported frame (hereinafter referred to as the movable frame) **41**, a rockably supported frame (hereinafter referred to as the rockable frame) **42** and a slidably supported frame (hereinafter referred to as the slide frame) **43**, disposed at the opposite ends thereof, and the first frame **40** is generally supported for movement relative to the second frame **50**. Also, the first frame **40** holds the developing roller **20** and the developing blade **22**. The developing roller **20** has its

opposite ends rotatably supported by the rockable frames **42** and the slide frames **43** through bearings **27**. Also, the spacer runners **26** substantially concentric with the developing roller **20** and having an outer diameter larger by a predetermined gap than the outer diameter of the developing roller **20** are slidably provided at the opposite ends of the developing roller **20**. The developing blade **22** as regulating means for regulating the amount of toner on the developing roller **20** is formed integrally with or adhesively secured to a developing blade metal plate **28**. The developing blade metal plate **28** is fixed to the movable frame **41**, and the distal end of the developing blade **22** abuts against the developing roller **20**.

As shown in FIG. **4**, the first frame **40** is installed in the second frame **50**.

The second frame **50** is fixed to the toner container **21**. The rockable frame **42** of the first frame **40** is provided with a rockable arm **46** having a rocking hole **47** in the end portion thereof, and the second frame **50** is provided with a supporting arm **55** having a fixing hole **56** in the end portion thereof, and the rockable frame **42** and the second frame **50** are rockably engaged with each other by an engagement pin **80**. The rocking hole **47** of the rockable frame **42** and the engagement pin **80** are slidable relative to each other, and the fixing hole **56** of the second frame **50** and the engagement pin **80** are force-fitted to each other. The biasing springs **32** are provided between the first frame **40** and the second frame **50**. (Specifically, the biasing springs (see FIGS. **4** and **10**, the biasing spring on the spring receiving portion **51***f* side being not shown) are attached to spring receiving portions **51***e* and **51***f* of the second frame **50**.) The developing roller **20** provided in the first frame **40** is urged against the photosensitive drum **10** with a constant clearance by the spacer runners **26**. By the biasing springs **32** being thus disposed, the developing device can be made compact. While in the present embodiment, the second frame **50** is fixed to the toner container **21**, the second frame **50** may be formed integrally with the toner container **21** (by integral molding).

As shown in FIG. **5**A, slide flat surfaces **43***a* and **43***b* for determining the slide direction are provided on the substantially upper and lower surfaces of the slide frame **43** parallel to each other. On the other hand, guide flat surfaces **51***a* and **51***b* are provided at regions opposed to the slide flat surfaces **43***a* and **43***b* of the slide frame **43**, with a minute clearance provided therebetween, when the first frame **40** is installed in the second frame **50**. Further, in order to effect the lengthwise positioning of the second frame **50** and the first frame **40**, a positioning boss **52** is provided on the second frame **50**, and a positioning slot **41***a* for determining only the lengthwise direction is formed in the movable frame **41**. The slide frame **43** can be slid in a predetermined direction by the slide flat surfaces **43***a*, **43***b* and the guide flat surfaces **51***a*, **51***b*. As an alternative construction, as shown in FIG. **5**B, slide rail convex portions **43***c* and **43***d* for determining the slide direction are provided on the substantially upper and lower surfaces of the slide frame **43**, and slide rail concave portions **51***c* and **51***d* are provided at the opposed regions of the second frame **50**. The rail fitting portion of the slide frame **43** may be made of a construction for positioning the lengthwise direction of the slide frame **43** and the second frame **50**.

FIG. **6** shows a toner seal construction for the first frame **40** and the second frame **50**. Elastic seal members **44** and an elastic seal member **45** are fixed to the shorter side portions at the opposite ends and the upper longer side portion, respectively, of the first frame **40** by adhesive-double-coated-tapes, and are compressed by the receiving surfaces **57** and **58** of the second frame **50** shown in FIG. **7** to thereby provide the sealing effect of preventing the leakage of the toner. In FIG. **8**, the double-headed arrows "s" and "t" indicate the directions of compression of the elastic seal members **44** on the shorter side portions at the opposite ends and the elastic seal member **45** on the upper longer side portion, respectively. Here, the direction of compression of the elastic seal member **45** is set so as to be a direction substantially perpendicular to the direction of movement of the first frame **40**. By doing so, it is possible to decrease the influence of the repulsive force of the elastic seal member **45**, which is larger in a compression area, upon the pressure force with which the developing roller **20** is urged against the photosensitive drum **10** and stabilize the pressure force.

Also, a jet preventing sheet **25** is fixed to the lower longer side portion **54** of the second frame **50** by an adhesive-double-coated tape so as to abut against the developing roller **20** and prevents the leakage of the toner in the radial direction of the lower portion of the developing roller **20**. By doing this, it is unnecessary to adopt a construction in which an elastic seal member is disposed on the lengthwise lower surface of the first frame **40**, and it is possible to realize the compactness of the apparatus.

FIG. **9** shows toner seals on the opposite end portions of the developing roller **20**. A magnetic seal **60** is provided with a plurality of magnetic poles on the surface **60***a* thereof opposed to the surface of the developing roller **20**, and is sealing means for adsorbing the toner by the magnetic curtain between itself and the developing roller **20**. The magnetic seal **60** is inserted and positioned in a recess (not shown) formed in the movable frame **41**, and is urged and fixed by the developing blade metal plate **28**. The developing roller **20** and the magnetic seal **60** are fixed to the same first frame **40**. Consequently, even if the developing roller follows the outer periphery of the photosensitive drum **10** and the first frame **40** moves, the clearance between the developing roller **20** and the magnetic seal **60** can be accurately set constantly. Therefore, the toner sealing of the opposite end portions of the developing roller **20** by the magnetic seal **60** can be done well.

FIG. **10** is a schematic view of a driving system for the developing roller **20** in the present embodiment. A drum gear **71** provided at an end portion of the photosensitive drum **10** has a driving force transmitted thereto from the image forming apparatus (not shown) through a driving gear **70**, and rotatably drives the photosensitive drum **10**. On the other hand, the drum gear **71** rotatably drives a developing roller gear **72** provided coaxially with the developing roller **20**. In FIG. **10**, the arrow "a" indicates the direction of an acting force acting on the developing roller gear **72** when the drive is transmitted from the drum gear **71** to the developing roller gear **72**. The arrow "b" in FIG. **10** is a line linking the center of the rocking movement of the rockable frame **42** and the acting point (the meshing point on a pitch circle) of the acting force acting on the developing roller gear **72** together. When the angle formed by the arrow "a" with the horizontal line is defined as θa and the angle formed by the arrow "b" with the horizontal line is defined as θb, the following relation is established therebetween: $\theta a \geqq \theta b$. As a result, the acting force acting on the developing roller gear **72** acts in a direction to urge the developing roller **20** against the photosensitive drum **10**. Therefore, the pressure between the developing roller **20** and the photosensitive drum **10** is not decreased under the influence of the acting force, and the spacer runners **26** are not spaced apart from the photosensitive drum **10** by the action of a slight extraneous force.

As described above, the design is made such that driving is effected on the rockable frame side, whereby an increase

in a frictional resistance force on the slide surface, created by the influence of a force acting during the transmission of a driving force when sliding movement is adopted, can be avoided. Also, on the slide side at the other end, such parts as a member constituting a rocking shaft and a rockable arm can be curtailed and therefore, there can be provided a compact and low-cost developing device.

FIG. **11** shows a construction which is another embodiment in which the developing roller **20** is driven on the slide frame side. In this construction, the developing roller gear **72** is disposed on the slide frame side. In FIG. **1**, the arrow "a" indicates the direction of an acting force acting on the developing roller gear **72** when a driving force is transmitted from the drum gear **71** to the developing roller gear **72**. The angle of the slide flat surfaces **43***a* and **43***b* of the slide frame **43** may be a right angle with respect to the arrow "a", or may be set to an angle at which, when an acting force acts on the slide flat surfaces **43***a* and **43***b*, the force urges the first frame **40** toward the photosensitive drum **10**. In FIG. **11**, the reference letter "F" designates a force created by the acting force acting on the developing roller gear **72**. The reference letters "Fy" denote a component force in a direction perpendicular to the guide flat surface **51***b* for the force F, and the reference letters "Fx" designate a component force in a direction parallel to the guide flat surface **51***b* for the force F. The component force Fx is directed to the photosensitive drum **10**. By doing this, under the influence of the acting force from the gear **72** when the developing roller **20** is driven, the pressure between the developing roller **20** and the photosensitive drum **10** is not decreased and the spacer runners **26** are not spaced apart from the photosensitive drum **10** by the action of a slight extraneous force.

Also, in the present embodiment, as previously described, the first frame **40** has one end thereof in the lengthwise direction (the axial direction of the developing roller **20**) supported for rotation relative to the second frame **50** and the other end thereof in the lengthwise direction slidably supported. However, as another embodiment, both ends in the lengthwise direction may be rotatably supported or both ends in the lengthwise direction may be slidably supported.

Also, in the present embodiment, as previously described, the developing unit A is a unit having the first frame **40** for supporting the developing roller **20**, the second frame **50** for movably supporting the first frame **40**, and supporting the toner container **21**, and the biasing spring **32**. Also, the photosensitive member unit B has the photosensitive drum **10**, the charging means **11**, the waste toner container **12** and the cleaning means **14**. Consequently, the connecting and assembly of the developing unit A movably supported by the first frame **40** and the photosensitive member unit B can be done easily.

As described above, the effect of the present invention is to provide the capability of stabilizing the pressure force of the developing roller **20** toward the photosensitive drum or the image bearing member **10**. Particularly, it has become possible to stabilize the pressure force of the developing roller **20** toward the image bearing member **10** independently of the amount of developer in the developer containing portion.

Also, the developing unit A has the developing roller **20** for developing the electrostatic latent image formed on the image bearing member**10**, the developer containing portion for containing therein the developer to be supplied to the developing roller **20**, the first frame **40** for supporting the developing roller **20**, the second frame **50** for movably supporting the first frame **40**, and supporting the developer containing portion, and the biasing spring or urging member **32** for urging the developing roller **20** toward the image bearing drum member **10**, whereby the pressure force of the developing roller toward the image bearing member **10** can be stabilized and at the same time, the assembling property of the process cartridge C can be improved.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

What is claimed is:

1. A developing device comprising:

a developing roller configured and positioned to develop an electrostatic latent image formed on an image bearing member;

a developer containing portion configured and positioned to contain developer to be supplied to said developing roller;

a first frame configured and positioned to support said developing roller;

a second frame configured and positioned to movably support said first frame, and supporting said developer containing portion; and

an urging member configured and positioned to urge said developing roller toward the image bearing member.

2. A developing device according to claim **1**, wherein said urging member is provided between said first frame and said second frame.

3. A developing device according to claim **1**, wherein said first frame is supported for rotation relative to said second frame.

4. A developing device according to claim **1**, wherein said first frame is supported for sliding movement relative to said second frame.

5. A developing device according to claim **1**, wherein said first frame has one end thereof in an axial direction of said developing roller rotatably supported and the other end thereof in said axial direction slidably supported, relative to said second frame.

6. A developing device according to claim **1**, wherein said developer containing portion is fixed to said second frame.

7. A developing device according to claim **1**, wherein said developer roller is provided with a spacer for keeping the spacing between said developing roller and the image bearing member constant.

8. A developing device according to claim **1**, wherein said first frame is provided with a regulating member configured and positioned to regulate the amount of the developer on said developing roller.

9. A process cartridge detachably mountable to a main body of an electrophotographic image forming apparatus, said process cartridge comprising:

an image bearing member; and

a developing unit having a developing roller configured and positioned to develop an electrostatic latent image formed on said image bearing member, a developer containing portion configured and positioned to contain developer to be supplied to said developing roller, a first frame configured and positioned to support said developing roller, a second frame configured and positioned to movably support said first frame, and supporting said developer containing portion, and an urging member configured and positioned to urge said developing roller toward said image bearing member.

10. A process cartridge according to claim **9**, wherein said urging member is provided between said first frame and said second frame.

11. A process cartridge according to claim **9**, wherein said first frame is supported for rotation relative to said second frame.

12. A process cartridge according to claim **9**, wherein said first frame is supported for sliding movement relative to said second frame.

13. A process cartridge according to claim **9**, wherein said first frame has one end thereof in an axial direction of said developing roller rotatably supported and has the other end thereof in said axial direction slidably supported, relative to said second frame.

14. A process cartridge according to claim **9**, wherein said developer containing portion is fixed to said second frame.

15. A process cartridge according to claim **9**, wherein said developing roller is provided with a spacer for keeping the spacing between said developing roller and said image bearing member constant.

16. A process cartridge according to claim **9**, wherein said first frame is provided with a regulating member configured and positioned to regulate the amount of the developer on said developing roller.

17. A process cartridge according to claim **9**, further comprising:

charging means for charging a surface of said image bearing member; and

cleaning means for removing residual toner remaining on the surface of said image bearing member, and storing the removed residual toner.

18. A process cartridge according to claim **9**, wherein said process cartridge is constituted by connecting an image bearing member unit supporting said image bearing member with said developing unit.

19. An image forming apparatus to which a process cartridge is detachably mounted for forming an image on a recording medium, said image forming apparatus comprising:

(i) said process cartridge having an image bearing member and a developing unit, said developing unit having a developing roller configured and positioned to develop an electrostatic latent image formed on said image bearing member, a developer containing portion configured and positioned to contain a developer to be supplied to said developing roller, a first frame configured and positioned to support said developing roller, a second frame configured and positioned to movably support said first frame, and supporting said developer containing portion, and an urging member configured and positioned to urge said developing roller toward said image bearing member;

(ii) supporting means for detachably and mountably supporting said process cartridge; and

(iii) conveying means for conveying the recording medium to said image bearing member.

20. An electrophotographic image forming apparatus to which a process cartridge is detachably mountable for forming an image on a recording medium, said electrophotographic image forming apparatus comprising:

(i) supporting means for detachably mounting the process cartridge, the process cartridge having an image bearing member and a developing unit, the developing unit having a developing roller configured and positioned to develop an electrostatic latent image formed on the image bearing member, a developer containing portion configured and positioned to contain developer to be supplied to the developing roller, a first frame configured and positioned to support the developing roller, a second frame configured and positioned to movably support the first frame, and supporting the developer containing portion, and an urging member configured and positioned to urge the developing roller toward the image bearing member; and

(ii) conveying means for conveying the recording medium.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

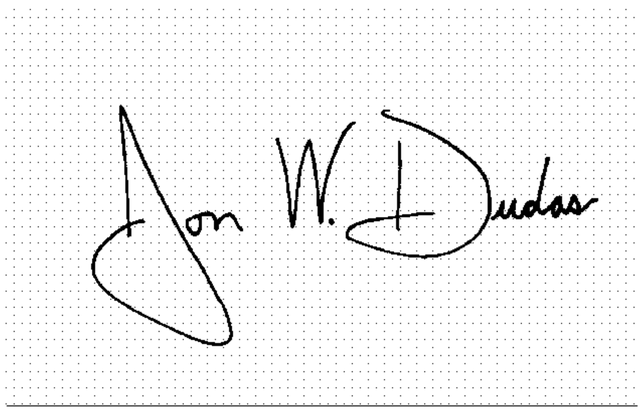
PATENT NO. : 6,671,477 B2
DATED : December 30, 2003
INVENTOR(S) : Noriyuki Komatsu et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 3,
Line 29, "means S," should read -- means 5, --.

Signed and Sealed this

Twenty-ninth Day of June, 2004



JON W. DUDAS
Acting Director of the United States Patent and Trademark Office